1 475 678

PATENT SPECIFICATION

(11) 1 475 678

(21) Application No. 42713/73 (22) Filed 11 Sept. 1973
(23) Complete Specification filed 3 Sept. 1974
(44) Complete Specification published 1 June 1977
(51) INT CL² B23K 19/02
(52) Index at acceptance B3R 14 15 6
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(19)

(54) AN IMPROVEMENT IN OR RELATING TO EXCAVATOR BUCKET PIVOT PINS

(71) We, WOODHOUSE & RIXSON LIMITED, a British Company, of Bessemer Road, Sheffield 9, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to the friction welding of a cylindrical metal shaft member to a steel plate to form a pivot pin for connecting together a pair of adjacent buckets in a chain of excavator buckets.

According to one aspect of the invention, there is provided a method of friction welding a cylindrical metal shaft member to a steel plate to form a pivot pin for connecting together an adjacent pair of excavator buckets, the method including the initial step of forming at least said shaft member so that it has an annular projection at which friction welding is to take place, the annular projection on said shaft member being inwardly spaced from its external periphery, and the two parts are then brought together under pressure as one rotates relative to the other, the "flash" which results as friction welding takes place lying wholly or almost entirely within the external periphery of the shaft member. The radial width and the axial length of the or each annular projection will preferably be such that the "flash" formed during the friction welding operation will substantially fill the annular space formed at the junction of the shaft member and the steel plate when the two are first brought together, the width of said space having been somewhat diminished by the crowding together of the shaft member and plate. The method may also involve the step of skimming the surface of the steel plate to produce a flat area within which the shaft member is to be friction welded. The method may involve the step of forming the plate with an annular projection complementary to the projection formed on the cylindrical shaft member so that when the two are brought together for friction welding the annular projection formed on said cylindrical shaft member is urged into engagement with the annular projection formed on the plate.

According to a further aspect of the invention, there is provided a pivot pin including a cylindrical shaft member and a steel plate for connecting together an adjacent pair of excavator buckets, the shaft member and plate having been friction welded together as described above so that at the junction between the two parts the "flash" which has been formed during the friction welding operation lies wholly or almost entirely within the external periphery of the shaft member.

According to a still further aspect of the invention, there is provided a plurality of excavator buckets pivotally connected together by respective pivot pins which have been produced by the method described above.

In order that the invention may be fully understood and readily carried into effect, the same will now be described, by way of example only, with reference to the accompanying drawings, of which:—

Fig. 1 is a semi-diagrammatic side view of a plurality of excavator buckets connected together by respective pivot pins embodying the invention,

Fig. 2 is a view from beneath said buckets,

Fig. 3 is a perspective view illustrating the pivotal connection of a pair of the buckets,

Fig. 4 is a diagrammatic view of two components which are to be friction welded together by a method embodying the invention to produce the pivot pin for connecting a pair of buckets together.

Fig. 5 is a view of the components as the friction welding process is being carried out,

Fig. 6 is a perspective view of the resulting pivot pin,

Fig. 7 is a view similar to Fig. 4 but illustrating a possible modification which may be made, and

Fig. 8 is a view similar to Fig. 5 showing the components of Fig. 7 being friction welded together.

Referring now to Figs. 1 to 3 of the drawings, these illustrate the pivotal connection of a plurality of excavator buckets such as the pair of buckets 10 and 12 by a pivot pin 14 having a shaft member *S* and a plate member *P* at one end, said plate member being recessed into one of the apertured lugs through which the pin extends to connect the buckets together. A cotter pin 16 is used to secure the plate member *P* in its recess as shown.

Referring now to Fig. 4, this illustrates two components which are to be friction welded together to form the pivot pin 14 referred to, that is to say the cylindrical steel shaft member *S* and the steel plate member *P*. The face 18 of the plate *P* has been skimmed to produce a flat area within which the shaft member *S* is to be friction welded and the latter has been machined at its end which is to be welded to the plate so that it has an axially extending annular projection 20 inwardly spaced from its external periphery.

The form of the end of the cylindrical shaft member is such that when the two parts are brought together under pressure as one rotates relative to the other, the "flash" 22 which results as friction welding takes place lies wholly or almost entirely within the external periphery of the shaft member (and of course it will be understood that if the "flash" does project very slightly proud of the periphery of the shaft member it can very easily be removed by a simple grinding or dressing operation with less trouble than if the procedure described had not been followed to confine the "flash", or at least most of the "flash", within the annular space formed at the junction of the shaft member and steel plate when the two are first brought together).

It will be understood that the required radial width and axial length of the annular projection formed on the shaft member, and the distance by which it is spaced radially inwards of the outside periphery of the shaft member, will depend on various factors, for example on the diameter of the shaft portion and possibly on the composition of the steel of which the two parts are made, and may be determined by trial and experiment so that the "flash" formed during the friction welding operation will substantially fill the annular space formed at the junction of the shaft member and the steel plate when the two are first brought together, or more correctly that space somewhat diminished by the crowding together of the two parts and the melting of a portion of the annular projection on the shaft member as friction welding takes place. (In Fig. 6, which is a perspective view of the finished pivot pin, the annular space formed at the junction of the shaft member and the steel plate is not shown since it will have been substantially filled by the flash and will not be readily distinguishable from a conventionally formed pivot pin, especially if a simple grinding or dressing operation has been carried out to remove a slightly projecting amount of "flash" as previously mentioned).

It has been found that the pivot pin described above can be produced very much more cheaply than by other more conventional methods.

Referring now to Figs. 7 and 8, these illustrate a possible modification which has been found advantageous in obtaining satisfactory friction welds of the component parts. In Fig. 7 it will be seen that the pin is substantially the same as before in having been formed with an axially extending annular projection 20 inwardly spaced from its external periphery. The plate member, however, has in this case also been formed with an annular projection 24 complementary to the projection formed on the cylindrical shaft member so that when the two components have been brought together, as shown in Fig. 8, for friction welding the annular projection 20 formed on said cylindrical shaft member is urged into engagement with the annular projection 24 formed on the plate. (When the shaft member and plate member have been brought together there has been formed an annular space surrounding the abutting projections in the same way as before). The result is that the heat which is produced as the two components are crowded together, as one rotates relative to the other, cannot as easily pass into the body of the plate. Consequently, greater heat is concentrated in the region of the abutting portions and a better weld has been produced.

Various other modifications may be made without departing from the scope of the invention and in particular it should be noted that it may be found that it is not essential for the surface of the steel plate to be skimmed to produce a flat area within which the shaft member is to be friction welded. It is of course not essential for the steel plate to be formed with an annular projection as illustrated in Fig. 7 before the friction welding operation is carried out.

WHAT WE CLAIM IS:—

1. A method of friction welding a cylindrical metal shaft member to a steel plate to form a pivot pin for connecting together an adjacent pair of excavator buckets, the method including the initial step of forming at least said shaft member so that it has an annular projection at which friction welding is to take place, the annular

projection on said shaft member being inwardly spaced from its external periphery, and the two parts are then brought together under pressure as one rotates relative to the other, the "flash" which results as friction welding takes place lying wholly or almost entirely within the external periphery of the shaft member.

2. A method according to claim 1, in which the radial width and the axial length of the or each annular projection is such that the "flash" formed during the friction welding operation substantially fills the annular space formed at the junction of the shaft member and the steel plate when the two are first brought together, the width of said space having been somewhat diminished by the crowding together of the shaft member and plate.

3. A method according to either one of the preceding claims, the method also involving the step of skimming the surface of the steel plate to produce a flat area within which the shaft member is to be friction welded.

4. A method according to either one of claims 1 and 2, the method also involving the step of forming the plate with an annular projection complementary to the projection formed on the cylindrical shaft member so that when the two components are brought together for friction welding the annular projection formed on said cylindrical shaft member is urged into engagement with the annular projection formed on the plate.

5. A pivot pin including a cylindrical shaft member and a steel plate for connecting together an adjacent pair of excavator buckets, the shaft member and plate having been friction welded together by the method claimed in any one of the preceding claims so that at the junction between the two parts the "flash" which has been formed during the friction welding operation lies wholly or almost entirely within the external periphery of the shaft.

6. A plurality of excavator buckets pivotally connected together by respective pivot pins which have been produced by the method claimed in any one of claims 1 to 4.

7. A method of friction welding a cylindrical shaft member to a steel plate to produce a pivot pin for connecting together an adjacent pair of excavator buckets, substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

8. A pivot pin including a cylindrical shaft member and a steel plate, substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

9. A plurality of excavator buckets connected together by pivot pins substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1977.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

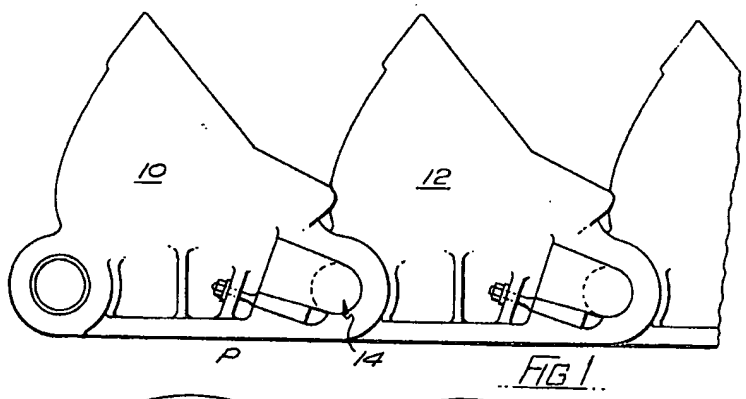

FIG 1

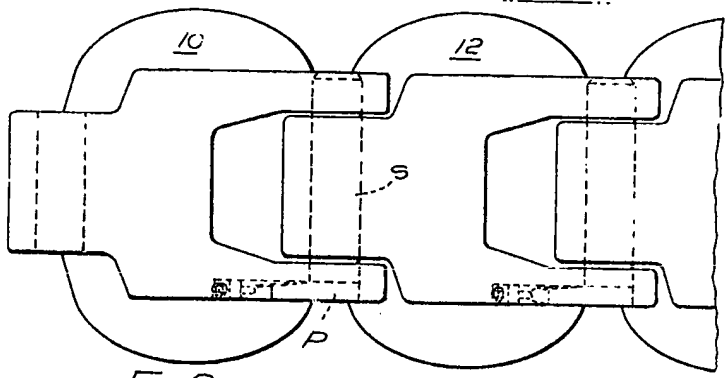

FIG. 2

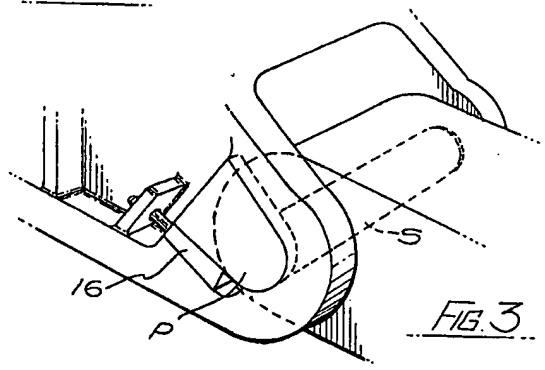

FIG. 3

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Sheet 2

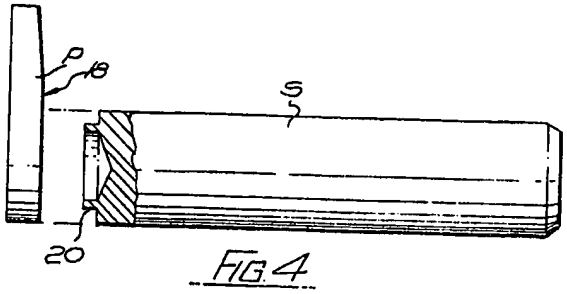

FIG. 4

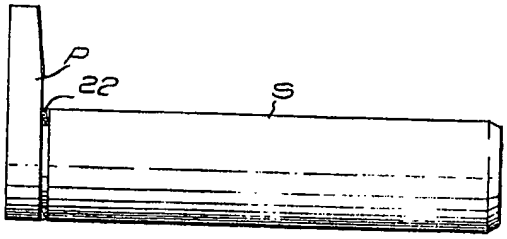

FIG. 5

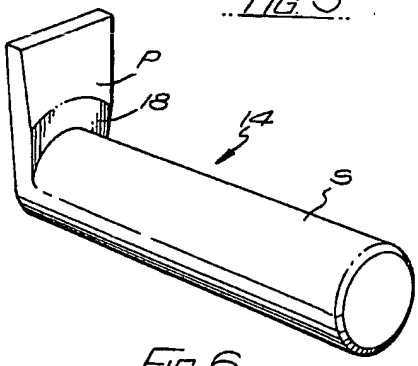

FIG. 6

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Sheet 3

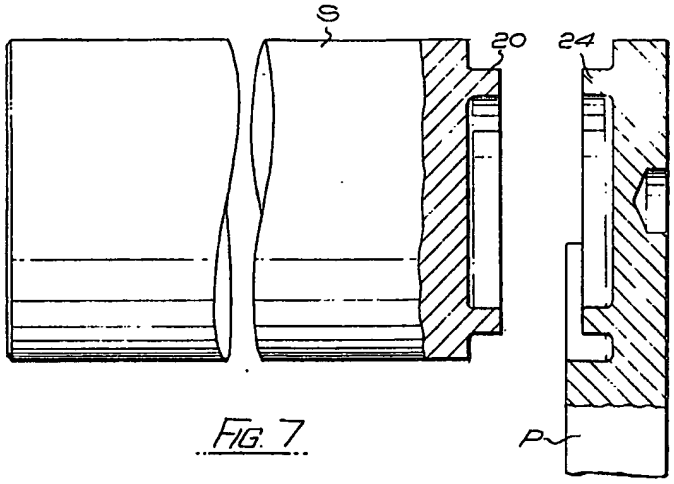

FIG. 7

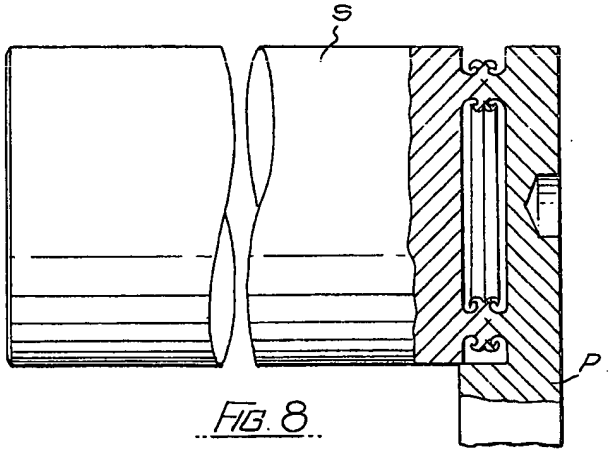

FIG. 8